ELECTRICAL REVIEW

[ILLUSTRATED]

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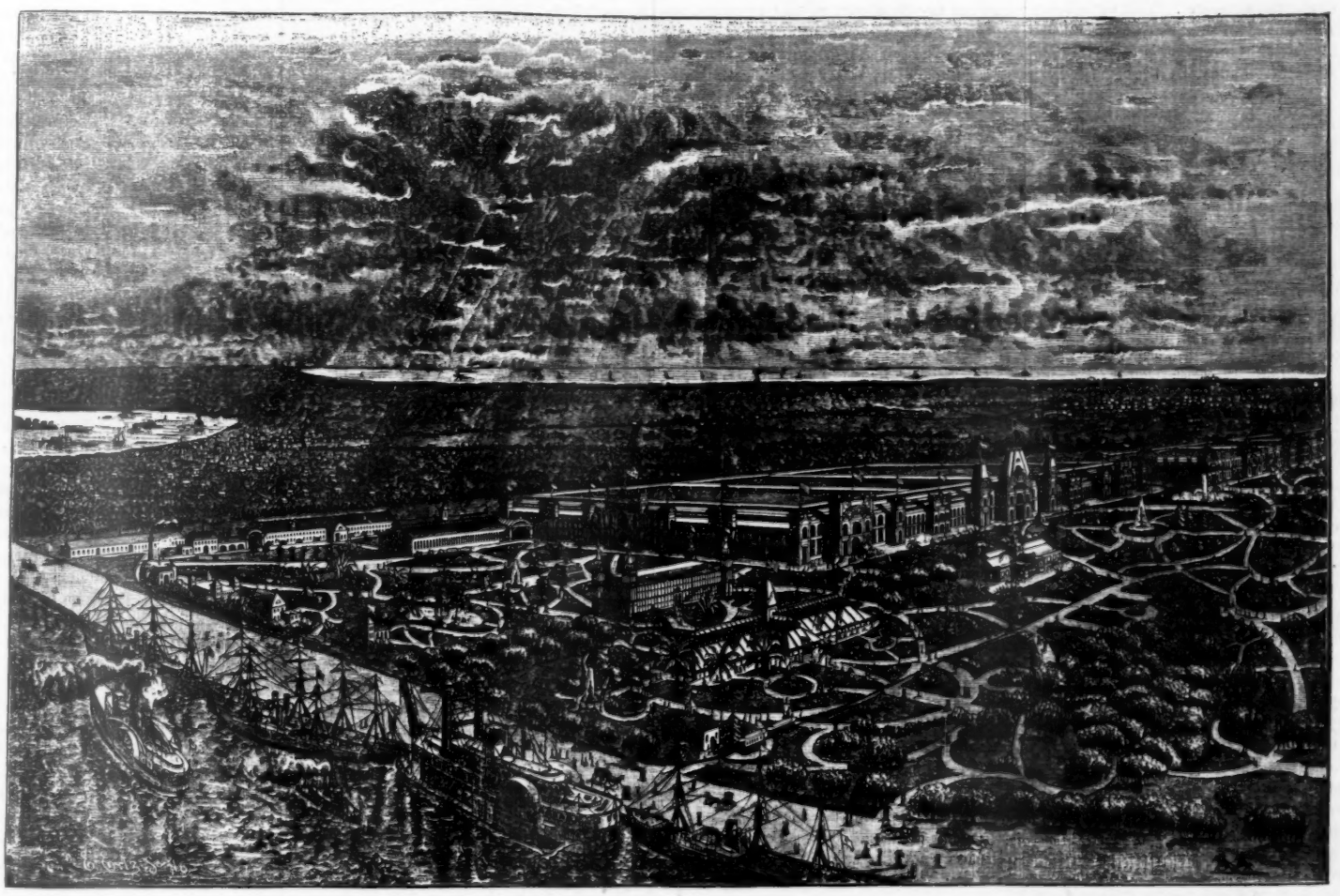
The World's Industrial and Cotton Centennial Exposition at New Orleans.

The engraving on this page is a perspective view of the World's Industrial and Cotton Centennial Exposition at New Orleans. The location is that of the City Park, a beautiful, level tract of land, containing 249 acres, resting on the left bank of the Mississippi River. In the left lower corner is a section of the river with steam vessels lying beside the levee which extends along one side of the park. The first large building that the eye rests on in the lower right center is the Horticultural Hall. It has a square, high, central tower and is the largest conservatory in the world, being 600 feet long and 194 feet at its widest part. Nestling in front of the largest building is the Art Gallery. The most commanding architectural feature of the view is the Main Building. This is the largest building in the world, and covers thirty-three acres of space. There is within this building a Mu-ic Hall large enough to accommodate eleven thousand persons. Projecting from the left further corner is the Factories and Mills Building, 350x120 feet, and it is really a continuation of the machinery department that occupies a space 300x1378 feet on the further side of the largest building of the group Notwithstanding the deductions of space made on various accounts, the alleyways of the Main Building to be used by visitors in inspecting exhibits, actually measure five miles and three hundred and thirty feet. The Mexican buildings (that of the National Headquarters not shown) and a number of others, are entitled to mention, but space permits of only a mere allusion to the United States and State Exhibits building, which is seen on the right of the view and beyond the Main Building. It is 896 feet long by 576 feet wide and larger than the main building used at the Paris Exposition, and also larger than the main building of the Vienna Exhibition. The United States and collective State exhibits will be placed in this building.

The Carrolton suburb of the city borders the river to the left, and the rear of the city extending toward Lake Pontchartrain is shown in the background. The two railway lines visible in the distance are those of the Great Jackson route and the Mississippi Valley.



VIEW OF THE WORLD'S INDUSTRIAL AND COTTON CENTENNIAL EXPOSITION GROUNDS AND BUILDINGS, NEW ORLEANS, LA.

On Electric Lighthouses.

The author, commencing with a short historical sketch of his subject, refers to the discussion raised last year on the spectrum of light according to the source whence it is derived. In the solar spectrum the two central colors, the yellow and the green, represent approximately three-fourths of the entire luminous intensity. The blue, indigo, and violet make up 14 per cent. and the red and orange 11 per cent.

SOLAR SPECTRUM.	
Yellow and green	0.75
(*a*) Blue, indigo, and violet	0.14
(*b*) Red and orange	0.11
	1.00

The rays from the blue to the violet are the most refrangible, and are almost completely absorbed by fog, whilst the red and orange traverse it easily. A light in the spectrum, of which the blue, indigo, and violet rays (more refrangible) predominate over the red and orange rays (less refrangible), seems as if it ought to carry less far in a fog than one in which the red and orange rays predominate over the blue, indigo, and violet. The electric light is in the former case, and the light of oil and of gas in the latter.

I wish to show that science has penetrated this new fog which has been raised before the voltaic arc.

Above all things it is necessary to call to mind in how small a proportion the range of a lighthouse is increased by a very great augmentation of its source of light. I borrow the following figures and results of calculations from two memoirs by M. Allard—on "The Use of the Electric Light in Lighthouses," and on "The Intensity and the Range of Lighthouses." Let us take, as example, a lighthouse of the first rank, using mineral oil, like that of Dunkirk, giving a light of 6,250 carcels. Let us consider at the same time a luminous intensity 20 times stronger, that is, of 125,000 carcels, and seek the difference of the range of these two lights. In the mean state of transparency of the atmosphere for the Channel the ranges corresponding to these two intensities are 53 kilometers and 75.40 kilometers. We have gained 22 kilometers, or 42 per cent. The range has been increased as 1 : 1.42, whilst the intensity has been augmented as 1 : 20.

Let us now consider a less transparent state of the atmosphere, at or below which the air on the Channel remains for about one-twelfth of the year. The ranges are then respectively 24 and 32 kilometers. We have gained only 8 kilometers, or 34 per cent.

Lastly, in foggy weather, such as prevails on an average for 10 nights yearly, the ranges are 3.7 and 4.6 kilometers. We gain less than 1 kilometer, or scarcely 24 per cent., by increasing the light twenty-fold.

These general data being laid down, let us return to the composition of the electric light. It contains less of non-refrangible rays (*b*) than does the light of oil or gas, but in what proportions? In the absence of exact figures, which we do not possess, M. Allard proceeds by hypothesis. He has carried his hypothesis even beyond the limits of possibility by as-

suming that the electric light is one-half poorer in red and orange rays than the light of oil or gas. He has, moreover, intentionally made the co-efficient of penetration of these same red and orange rays unfavorable to the electric light. Under these conditions he has calculated the range in foggy weather on the Channel:

1. Of the luminous intensity with oil at 6,250 carcels, and finds it 3.805 kilometers. 2. Of a luminous intensity with oil at 125,000 carcels, which he finds 4.740 kilometers; and, 3. Of an electric luminous intensity of 125,000 carcels, which is 4.696 kilometers.

Thus, when the state of the atmosphere is such that an oil light of 6,250 carcels is only visible at 3.805 kilometers, an oil light of 125,000 carcels will be seen at 4.740 kilometers, and an electric light of the same intensity will be seen at 4.696 kilometers. The loss of range of the electric light on the hypothesis made is therefore only 41 meters, or less than one per cent., and the real loss is evidently smaller.

It results from these remarkable investigations of M. Allard's that the notions hitherto prevalent on this subject are erroneous. The presence of the refrangible and absorbable rays to which the electric light owes its whiteness and its splendor, is the cause of a corresponding increase in the intensity of the red rays which penetrate farthest in a fog. The lights of oil and gas have only an advantage of one per cent. over the electric light in penetrating power. The experience of sailors had shown this previously, but the learned French engineer has proved it definitely, and his conclusions are everywhere adopted.

The question is thus simplified. As regards spectral composition and penetrative power in fogs, all lights are on the same level. It is now needful to examine which light is preferable for the illumination of lighthouses.

The luminous intensity of the 42 electric lighthouses recently established on the coasts of France has been calculated so as to fulfill on the ocean, during 10 months, conditions which oil lighthouses fulfill during 6 only. The exception (*i. e.*, the time during which a lighthouse is ineffectual) is reduced from one-half to two-twelfths, being thus rendered three times smaller. On the Mediterranean the exception will be reduced to one-fifteenth, that is, seven and a-half times smaller than it has been hitherto. To obtain such a result the lantern of a lighthouse must be able to project to the horizon a light equivalent to 125,000 carcels. Neither oil nor gas, at any cost, is capable of furnishing practically such a luminous intensity. The expenses of maintaining lighthouses with electricity and with oil, as compared by French and English engineers, show that a unit of light obtained by electricity costs from four to six times less than by oil, and from four to five times less than by gas. The more powerful an electric focus the less is its cost per unit of light. Lighthouses of the first rank must therefore be electric.

The author then notices the experiments on electric lighting with reference to lighthouses made at Blackwall, under the direction of Faraday, as far back as 1858. Between 1859 and 1861 numerous attempts at electric lighting were made at the South Foreland with the machines of Holmes, but the result was not satisfactory. In 1862 there was a new trial at Souter Point, still with the machines of Holmes. The intensity obtained was very feeble. Electric lighting soon ceased. In 1863 and 1865 the lighthouses of La Hève received the electric light furnished by the new machines of the Compagnie de l'Alliance. At this juncture our regretted vice-president, Count du Moncel, advised the suppression of the commutator and the use of the alternating currents for the direct production of the light. The result was conclusive, and the electric illumination of lighthouses was rendered practicable. At Odessa in 1866, at Souter Point in 1871, at Gris-Nez and the Lizard in 1878, the lanterns were illuminated with the voltaic arc.

The new dynamo-electric machines of Gramme and Siemens, more powerful than the machines of Holmes and of the Alliance, now made their appearance in lighthouses. The trials commenced at the Lizard, and were pursued at the South Foreland and at the depot of the lighthouse service in Paris. After experimenting for two years, it was found that with the same expenditure of mechanical force the dynamo-electric machines produced double the current of the Holmes and the Alliance machines. The trials were to be continued in the English lighthouses, and to be commenced in those of France, when in 1880 there appeared the magneto-electric machine, which I had just constructed.

It results from the reports of the English engineers, and from the experiments made at the Paris depot under direction of M. Allard, that for a given motive force expended these machines furnish as much, in an alternating current, as do the dynamos in a continuous current. There is no heating either in the bearings or in the movable rings; there is an absolute invariability in the inductors, a steady light in the lamps even with a certain variation in the speed of the motor; such are the advantages which were remarked at the very outset. The inductors of the machine are composed of 40 magnetized bundles for the French pattern, and of 60 for the new English pattern, of which I shall speak below.

The armatures have 80 bobbins for the French pattern and 120 for the new English pattern. These bobbins may be arranged at pleasure, either for quantity or tension, as may be found requisite. M. Lucas, when drawing up the theory of this machine, has supplied us with very elegant formulæ, indicating all the possible groupings. The only fault which can be found with this machine is its first cost, which is higher than that of a dynamo of the same power. But this condition is merely secondary in case of a public service as important as that of lighthouses, in which the certainty of regular work is a main condition. From 1863 to 1884 the lighthouses of La Hève, worked with magneto machines, have given full satisfaction as to regularity. It has not been the same from 1878 to 1880 with the dynamos at the South Foreland and the Lizard. The dynamo machine, notwithstanding its advantages of a reduced bulk and cost, is more delicate, and subject to derangements. The greatest efficacy of its light being at an angle of 45°, a machine must be used of a power at least double to get the same horizontal range as with a magneto. In course of time the collector will be worn out, as everything wears in service. The machine must then be sent back, perhaps by sea, to the workshop where it was constructed. When the rod which serves as a collector in the magneto machine is worn out, the mechanic of the lighthouse can put in a new one in its stead, and the machine will then be in a condition to work for several years.

If an accident happens to the armature of a magneto, the mechanic removes it, or any bobbins which are deranged, and executes the repairs himself.

If an accident happens to the armature of a dynamo, it must again be sent back to the works where it was constructed. These considerations have guided the lighthouse boards of France and England in selecting, as they have done, the magneto machine with alternating currents.

Other countries, which are only beginning the installation of their electric lighthouses, have been of the same opinion as the engineers of the two great maritime powers. Russia, Italy, Portugal, and the United States have adopted the magneto machine for their new lighthouses. This question of the machine best suited for lighthouses being thus decided, I must add that where it is required to supply glow lamps, to execute galvanoplastic work, or to drive a motor, I should be the foremost to recommend a dynamo in preference to a magneto.

Since the use of magneto machines has become general in lighthouses, the question concerning the power of the permanent magnets which in them serve as inductors has become of greater importance. To the theoretic researches of the savants who have marked out the track to be followed have been added the practical efforts of industrialists. But, unfortunately, after the numerous experiments of M. du Moncel, the remarkable investigations of M. Jamin, and the studies—no less ingenious than instructive—of Mr. Hughes, the cause of the phenomena remains unknown. The coercitive force of tempered steel has been determined. We know that it is at its maximum when the tempering has been effected at the greatest heat of the metal in the coldest liquid. But why are certain steels capable of acquiring, under the same conditions of tempering, a magnetic power very superior to certain others? The question remains unanswered. Why does a bar of the purest Sheffield steel make a less powerful magnet than a similar bar of Allevard steel containing a certain proportion of tungsten? Why is a similar bar of steel from the firm of Peugeot, of Valentigney, containing no tungsten, more powerful still? No one can tell. Why does a small telephone magnet, weighing a few hundred grammes, support twenty to thirty times its own weight, whilst one of 25 to 30 kilos, like that of my machines, barely supports three or four times its weight? "Divide the material," I shall be told; "multiply the number of plates as you have done for your induced bobbins—theory indicates it to you." I have made the experiment, and repeated it without obtaining any better result.

M. A. De Meritens.

The Great Atlantic Steamships.

The Cunard steamer Oregon concluded on Saturday, August 23, the fastest ocean trip from Queenstown to New York yet made, making the passage in six days and ten hours, and beating her own former record. The distance run each day, as per General Manager Downs' record, was as follows:

	KNOTS.
Monday	400
Tuesday	452
Wednesday	436
Thursday	452
Friday	448
Saturday	449
To Sandy Hook	181
Total	2,818

The two new large steamships now building for the Cunard Line, to sail on their Atlantic route between Liverpool, Boston, and New York, will come out here next spring. One of them, the Umbria, was launched last June, and the other, the Etruria, will soon follow. Both of these vessels are intended for what is called among steamship men fast vessels, *i. e.*, "express steamers," and the highest naval constructing and engineering talent has been employed in their design and construction. They are built of steel, and their hulls subdivided in water-tight compartments, to conform with the requirements of the British Admiralty, which feature in itself means the maximum degree of safety at sea. These vessels are the largest steamships that have ever been built on the Clyde. As can be seen in the following table, these new Cunarders are both shorter and deeper (proportionately) than the City of Rome and other steamships built lately, besides being (proportionately) wider. They will be engined to develop the enormous power of 12,500 horses, which, as Mr. Pearce, their builder, stated at the launch of the Umbria, will make them the most powerful steam craft in the world. How much they may lower the record of passages across the Atlantic is, of course, a matter of conjecture. The following table shows the comparative size and power of some of the leading steamers now running on the Atlantic:

Vessels.	Length between Perpendiculars—Feet.	Extreme Width—Feet	Depth of Hold—Feet.	Indicated H. P.	Gross Tonnage.
Alaska	500	50	38	11,000	6,932
America	442	51.2	36	7,500	5,528
Arizona	450	45.4	35.7	7,400	5,164
Aurania	470	57.2	37.2	9,500	7,269
Austral	456	48.2	33.9	7,000	5,589
City of Rome	560	52.3	37	10,000	8,144
City of Berlin	489	44.2	34.9	6,000	5,491
City of Chicago	431	45	33.6	6,600	5,202
Furnessia	445	44.8	34.5	5,500	5,195
Germanic and Britannic	445	45.2	33.7	7,000	5,008
Servia	515	52.1	37	8,500	7,392
Oregon	501	54.2	38	11,500	7,375
Umbria and Etruria	505	57	40	12,500	8,000

Mechanical Depolarization of Batteries.

Under this head, M. V. Bablon makes a few judicious reflections in our contemporary, *L'Electricien*. Although, when great intensity is required, an electrical generator of some type or other would naturally be preferred to a battery, still there are occasions where special circumstances may render the use of large batteries advisable. In such a case some mechanical means for depolarizing the positive electrode may be adopted with advantage, as the circular form of plate revolving in the liquid is inconvenient. The writer advises that the positive electrode consist of a supple metallic band passing over two rollers, the lower immersed in the liquid, and the upper caused to revolve. The portion of band not immersed in the liquid is of sufficient area for each successive point to become completely depolarized by contact with the air before being again immersed. The effect may also be increased by means of brushes rubbing against the band, and causing the liquid drawn up with it to fall down more quickly, thus effecting a more perfect contact of the surface with the oxygen of the air. The zinc pole is placed between the two sides, ascending and descending, of the positive electrode; and two other zincs may also be placed opposite the two other faces of the band, so as to increase as much as possible the active surface of the battery. The direction of the band, both in the liquid and out of it, may be varied according to the arrangement of the battery.

Technical Training.

At the opening of the Science and Art Classes in Naval Architecture, Machine construction, etc., for the ensuing winter season at Govan, on the 14th inst., Prof. F. Elgar, of Glasgow University, delivered an address to the students upon scientific training. While his remarks were intended to apply mainly to naval architecture, they are so general in their application that they cannot fail to interest and instruct those who are seeking to fathom the depths of electrical science. In the course of his address Professor Elgar said:

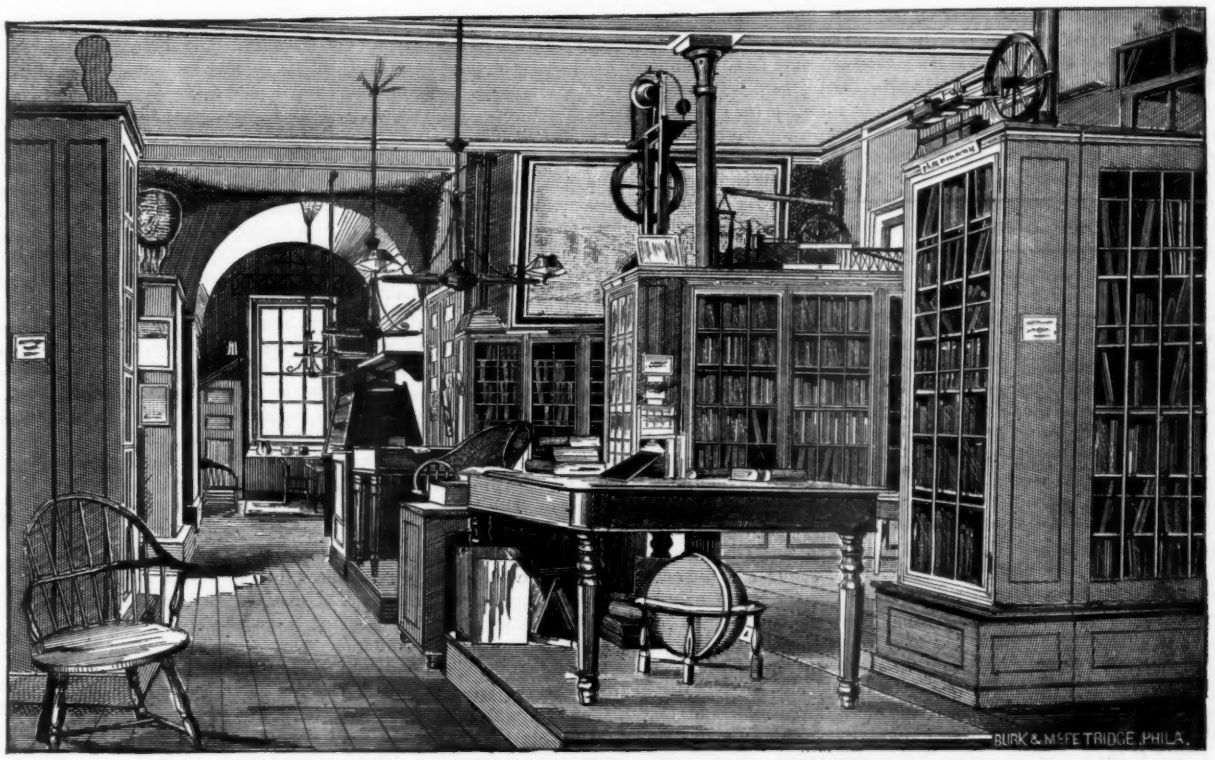
"All of the students who attend the classes in naval architecture and engineering here are probably much better acquainted with the practical and experimental aspects of the work they are engaged in than they are with the science which underlies it; and their present object is the very vital and praiseworthy one of acquiring such scientific and technical knowledge as will enable them to apply sound principles to the performance of their work, and will assist them in dealing intelligently and successfully with the many difficult and novel questions which are constantly obstructing and puzzling them. There are no branches of mechanical art in which sound scientific knowledge is more essential and useful, or in which it is more necessary for theory and practice to go hand in hand together, than in those of shipbuilding and engineering. A modern steamer is so complex a machine that no attempts to construct one without calling in the aid of science in some form—either directly or by copying what others have learned by it to do—could possibly end in anything but disastrous failure. Try to imagine a man who had never heard or read of any of the teachings of science attempting to construct a modern steamship—a man who did not know even of the proposition said to have been demonstrated by Archimedes, that a floating body displaces a volume of water whose weight is equal to its own weight; and who was ignorant of the wonderful discoveries that have been made of the laws by which heat generated by the combination of coal is converted into mechanical work through the agencies of the boiler and steam engine. It only requires to state the matter in this bald form in order to show how hopelessly impossible and absurd such an attempt would be, and how vitally dependent shipbuilding and engineering are upon the past achievements and present teachings of science. On the other hand, the highest scientific talent the world has yet produced would be equally unable to arrive at a successful result simply by means of

pure theory, however advanced, and by strict *a priori* methods. The course you are pursuing, and which I trust you will not depart from, is the one best calculated to insure for you the greatest success in your work and advancement in your various positions in life; and as in the daily practice of your profession, you are perforce kept well abreast of the practical and experimental sides of your work, I would now urge you, in the strongest manner possible, to cultivate most diligently and thoroughly a knowledge of the science and of those natural laws upon which the efficiency and success of your efforts mainly depend. Do not be content with merely learning methods of setting off work and performing calculations, or with copying processes you may have seen others employ. The man who merely does as he sees others do, without very well comprehending why they do it, and who works strictly by rule and line, looking to custom as his supreme authority, will never improve or advance himself, nor be of much real use in such times as these, nor will he find much interest in his work.

"Custom, which all mankind to slavery brings,
That dull excuse for doing silly things."

Never look to custom as being a sufficient authority for anything, however respectable its antiquity may have made it; but be determined to understand for yourselves whether or not it is based upon sound and intelligible principles. Do not be too eager to believe that anything you are told is correct until you are able to prove it for yourselves, and till you no longer feel any ignorance or doubt in the matter. The necessity for combining wide scientific knowledge and sound theory with practical experience in the carrying on of shipbuilding and engineering operations, is daily becoming more and more pressing. If you try to avoid it you could not. In this age of keen competition and rapid development, increasing demands are made upon all who are engaged in these important industries. Every success that is achieved by the most advanced and sensational productions creates a demand for still further progress, and in meeting these demands in the future the race will be to the swift and the battle to the strong. The speed and the strength that you require in order to enable you to hold your own in this contest are speed and strength of intellect. In other words, you require your intelligence to be cultivated and well informed and to be made prompt and active by means of scientific culture; and it is necessary for you to acquire such a firm and comprehensive grasp of sound theoretical principles as will enable you to rely safely upon your own powers of judgment, and to act in difficult cases with certainty and precision. Not only does modern competition ever demand more from you in the way of technical knowledge, skill and resource, but it also shortens the time at your disposal for supplying it. The huge and complicated engineering structures of the present day, which are constructed in this district, have to be completed in as short a time as the much simpler and smaller ones of a generation ago. You have thus not only much more to think about in building a ship, and problems of greater number and difficulty to solve than used to be the case, but you have only the same time for doing it all in. You cannot afford to delay the progress of construction for the purpose of trying experiments or brooding over any difficulties you may meet with. It is necessary to decide promptly each question as it arises, and you have to qualify yourselves for doing that. The naval architect and engineer of the present day requires to supplement his practical knowledge by a close and systematic study of various branches of science. An enumeration of some of the chief of them would be sufficient to show how great are the demands thus made upon him. No man has yet succeeded in completely mastering the difficult and complicated problems connected with shipbuilding; and it is, perhaps, not possible for many of you to advance very far towards their solusolution. Still it must be borne in mind that it is only by studying the sciences which bear upon them that any real or substantial progress can be effected, and although finality may be unattainable, great advances are possible, and are constantly being made. Hardly a year passes without something considerable being done to improve our knowledge of those natural laws upon which the safety and efficiency of ships at sea depend. There is probably no district in this country which has benefited in the past more than Govan by scientific progress and great mechanical skill in shipbuilding and engineering, or whose prosperity in the future is more dependent upon it. Govan has been placed among the foremost of shipbuilding communities by means of great scientific and practical talent, industry, and enterprise; and it rests with many whom I now see before me to maintain it in the honorable and tistinguished position to which it has been raised. The names of Napier and Elder, not to mention others, are alone sufficient to give prestige to any engineering locality; and they insure for Govan a high place in all future records of scientific, mechanical, and industrial progress. Upon you rests the responsibility of worthily walking in the footsteps of those and others among your distinguished men, and of striving to keep erect in this district the noble edifice they have reared. I am very pleased to find that students have such opportunities afforded them here for intellectual and social improvement, and still more pleased that so many have the good sense and the energy to avail themselves of them. I trust that the opportunities which exist will be added to and not diminished, and that the future generation of naval architects and engineers in Govan may thus be enabled to excel their fathers in all those qualities which will attract scientific and intellectual distinction to themselves and industrial prosperity to this neighborhood."

Prof. Elgar afterwards distributed the Science and Art Department certificates, and the local prizes gained by the students during the last session.



INTERIOR VIEW OF FRANKLIN INSTITUTE LIBRARY.

The United States Electric Lighting Company, using Weston's system, has one of the finest displays at the exhibition. Five of their dynamo machines are shown in that section of the exhibition, near the entrance, whilst the working plant is located next the Edison machines, at the northern extremity of the building. Ten of their machines are in action to produce the energy used in their electric lights. These machines are driven by three engines; a Porter-Allen, a Buckeye and a Southwark, each driving a separate system of dynamo machines.

The Weston system embraces three different forms of electric lighting, each requiring a modification of the dynamo. Be ides the arc, and the small 16-candle incandescent lamps, they use what are termed mammoth incandescent lights. All the dynamos are built on the same general plan, the differences being in the winding of the armature. The finer the wire of the armature, in general terms, the higher the intensity of the current produced. With this difference the same description will apply equally to all of them. Five of the machines are used for arc lighting, and vary from a capacity of 5 to one of 50 arc lights. In these machines the current generated has an electro-motive force of 1500 volts. In the two mammoth incandescent machines, the current has an electro-motive force of 160 volts, and in the three small lamp machines of about 120 volts.

In the Weston machine the field magnet is in shape somewhat like a double letter C, with the poles in the center. The magnets are oblong in section, and are wound in shunt circuit. Between the poles the armature revolves. The armature is formed of a core of discs of iron, strung upon the shaft like a string of beads, and separated from each other by insulating discs of paper. A cylinder is thus formed, which is wound in a modification of the Siemens method. The coils are very numerous, in order to equalize the current generated, and the shaft is insulated from the magnet by bearings of brass.

The Cost of the Electric Light in France.

A paper has recently been read by M. Ph. Delahaye, before the Societe Technique de l'Industrie du Gaz en France, giving an account of the progress made by the electric light during 1883. He commenced by a brief account of the inventions of the year, and turned to the question of expense, as compared with that of gas, founding his conclusions upon figures derived from typical installations. He stated that among manufacturing establishments the installation at the Cail workshops was among the most interesting, as it comprised both arc and incandescent lamps. The total superficial area illuminated is 251,880 square feet, and the number of lights 177, of which 94 are arc lamps and 83 incandescent lamps. The cost, without land and buildings, was £4,900, and the maintenance per hour is 1.07d. for the arcs and .10d. for the incandescent lamps, the power required being 1.38 horse-power for the former, and 10 kilogrammeters for the second. The total working expense is 19s. 2d., or .073d per carcel hour (one carcel=9.5 standard candles). The amortization and interest on capital, and the maintenance, taken together at 15 per cent., represent £736. Assuming a mean of 500 hours' lighting per annum there must be added on this account .0046d. per carcel hour, which will bring the total cost to .0076d. The total expense is £2 44 per hour, or equal to the cost of 7,167 cubic feet of gas at 6s. 9d. per 1,000 feet, a quantity of gas which M. Delahaye does not think will even be brought to yield the same amount of light as is furnished by the electricity.

He next takes the case of the Grand Magasins du Printemps, the lighting of which has been described in these columns. The lights burn five hours per day for 300 days in the year, with the exception of thirty Jablochkoff candles in the basement, which are in use nine hours per day. The annual cost for candles, carbons, and electric lamps is 60,900 francs (£2,436); the cost of the motive power (490,065-horse power hours) is 39,200 francs (£1,568); the expenses of the staff are 33,000 francs (£1,320); the amortization and interest, at 10 per cent., 68,400 francs (£2,736); and the maintenance, at 5 per cent., 29,200 francs (£1,168). The total expense is thus 230,700 francs (£9,228). M. Delahaye institutes two comparisons between this and gas lighting. First, he estimates what would be the price of a gas installation, and what it would cost per year; and second, what consumption of gas corresponds to the light furnished by the electricity. In the former case, assuming that there would be 3,000 gas burners, giving 9.5 candles each, and taking the price of gas at 6s. 9d. per thousand, and adding thereto 33 per cent. for amortization interest, supervision, etc., the yearly expense is 221,625 francs (£8,865), or almost the same as electricity. According to the latter mode of investigation, the consumption would be 69,509,760 cubic feet. At the price given above, the cost would be £31,015, or three and a half times as much as electricity. Of course such an amount of gas could not be burnt, as it would render the place uninhabitable.

M. Delahaye did not adduce any precise instance of incandescent lighting, but he gave a detailed estimate of its cost, and came to the conclusion that in an important installation it need not be dearer than gas at Paris cafes, a result that will meet with very general acceptance in this country, where some have been bold enough to argue that it might compete with gas at half the price at which it is supplied in Paris.

The paper is chiefly interesting in showing how favorably situated the electric light is in France, and how slow its progress is there even with the odds in its favor.—*Engineering.*

We are indebted to Messrs. Burk & McFetridge, publishers, Philadelphia, for the excellent cut showing interior view of Franklin Institute Library.

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In view of the recent decision of the courts, that the underground law passed at the last session of the legislature means that no more overhead construction is lawful, the city authorities of New York and Brooklyn find themselves in a very unpleasant predicament. Their police and fire-alarm systems are very extensive and require constant changes which involve the running of new wires, and this is unlawful. The probabilities are that both cities will apply to the legislature for a modification if not a repeal of the law.

It is gratifying to know that the men who conspired to give currency to the false and malicious libels against Mr. Loren N. Downs, which we printed and commented upon last week, are known and marked, and that they are in a fair way to be held responsible for their act and held up to public condemnation. The day of retribution is near at hand, and some whom we could name are going to pay a heavy penalty, not so much in money as in disgrace. Slow fire does not consume, *it only broils.*

THE GREAT SUIT.

The Bell-Drawbaugh hearing has dragged its slow length along through the week. We had hoped to give a synopsis of the arguments made on one side and the other, but it soon appeared that no synopsis which would do any sort of justice to Mr. Storrow or Mr. Hill could be got into the space at our disposal. The endeavor of Mr. Storrow has been to show that, despite the direct evidence of many witnesses to the contrary, Mr. Drawbaugh did not invent and operate a speaking magneto or electric telephone prior to the date of Professor Bell's patent, and he cited much testimony to prove the unreliability and inaccuracy of much of the direct and positive evidence offered by the defence. Mr. Hill, on the other hand, defended and upheld the accuracy of the evidence given by the witnesses called by his side, and argued from it the truth of the allegations made in support of Drawbaugh's claims. It may fairly be said that either argument, heard alone, would have carried great weight, and that, had both been addressed to a jury, they would have left its members in a hopeless state of uncertainty and doubt. But with a judge, trained to sift evidence, to eliminate what is immaterial, and to fix his mind only on what his trained perception shows him to be important, it will be quite another thing. The public, even were the whole evidence before it, would look at the thing "in a large way," judging by one or two salient points of evidence, and neglecting those minor facts which, to the judicial mind, are essential links in the chain. To sift these out, one by one; to go over all the testimony, page by page; to weigh every word of evidence carefully in the judicial scale, and estimate its importance and value; to reject that which is on its face, or in the light of other evidence, improbable and unbelieveable; to bring into the prominence which they deserve facts which have incidentally or inferentially been brought out; to apply to the whole the rules of law and of evidence—this is the work the judge has before him, the work for which his education as a lawyer and his experience as a judge fit him.

We say all this because we wish to put emphasis upon the idea, too often disregarded, that it is not the evidence alone which decides a case, and it is for this reason that what has come to be known as "trial by newspaper" is misleading, injurious, and presumably false. It is the evidence as colored and affected by the law, as seen through the eyes of the law, and weighed in the balance of the law, that decides causes, and it is only those who see through the law's eyes, hear through the law's ears and weigh in the law's balance who are fitted to give an opinion. To the layman, with but a slight—and therefore dangerous—knowledge of medicine, a certain symptom may seem to indicate a difficulty which requires only some simple remedy to obviate it. But the practiced eye of the physician may see other symptoms, slight in themselves, but important nevertheless, which show him that the difficulty is very different from what the layman supposed, and that the remedy which he purposed giving would do harm rather than good. That "a little learning is a dangerous thing" is as true in law as in medicine, and as we have committed the administration of justice to the courts, and selected men to dispense it who are presumed to be both learned and upright, it is a good deal better to wait for an authoritative decision than to speculate on the result without possessing either the evidence upon which it is based or the skill to dissect and weigh it.

The general feeling seems to be that an early decision is to be looked for. It is certainly to be hoped for, but scarcely, we think, to be expected. The judge has not only the evidence and the arguments to read carefully, and the exhibits to examine and test, but he has also to study out and determine many legal points which will arise in the course of his investigation, and to make himself strong by looking up and citing the authorities. If his decision were simply "yes," or "no," it might be easier, but custom, and a due regard for the rights of all, require that he should give reasons for the decisions reached, reasons which go on record, and are likely to be reviewed by a higher court. It is his wish, as it is his duty, to make his chain of reasoning so direct that it leads to his conclusion and to no other, and so strong that the Supreme Court of United States can find no flaw in it. This is what the judge has before him to do, and he certainly is justified in taking ample time to do it thoroughly. We know the importance of an early decision to both sides, but we do not look for it before the blossoms come next spring.

THE EXHIBITION.

The attendance at the Philadelphia Electrical Exhibition continues to be very large. The average receipts are now about $3,000 a day, and, in view of the fact that it was fully two weeks after the formal opening before the exhibits were really ready, it has been determined, as we learn on the authority of one the managers, to keep the exhibition open two weeks beyond the date originally set for closing, which was October 11. This will bring it up to October 25th, which is as late as many of the principal exhibitors can remain, as they have arranged to show these identical exhibits in New Orleans.

Were the Exhibition to close on the 11th of October, the books would show that, after paying all expenses, including the erection of the building—they aggregate not far from $80,000—there would remain a profit to the Franklin Institute, besides the building, of a few thousand dollars. But it is hoped, by keeping open two weeks longer, to do much better than this; in fact, to realize a cash profit of about $30,000. Then, next year, in this same building, it is proposed to hold an exhibition of all arts and industries, and out of this it is believed another $30,000 can be made, especially as there will be no expense for building. The Franklin Institute will sell its present building, which is old, dingy, and ill-adapted to the purpose for which it is used; and, with the proceeds, added to the funds mentioned, a suitable building will be erected, which will be a credit at once to the city and to the Institute.

Among the exhibitors there is a difference of feeling with regard to continuing the Exhibition beyond the time originally set. Those who were on hand and all ready on the opening day feel that there is no reason why they should be kept here for the accommodation of others who took no pains to be ready in time, while those who have but recently got their exhibits in order, naturally want as much grace as possible in order to bring them to the attention of the public.

How much benefit exhibitors have derived from the Exhibition is an unsettled question. The class of men whom they most wished to see, the electrical people of the country, have not attended generally, and their absence has been the cause of a good deal of regret. But that the city of Philadelphia has benefited in an educational way by the Exhibition, there is no manner of doubt. The great public has thronged the building; has asked endless questions, and has received new ideas concerning the power and value of electricity as a servant of man. The public in Philadelphia looks upon electricity as a practical thing; a thing to be used in many ways of which it had before no conception, and has become so familiarized with it that it looks no longer upon this subtle fluid as a thing mysterious and fearful, but rather, as we have all learned to look upon steam, as an obedient servant, familiar to us all, and readily adapted to our purposes.

It deserves to be said, and we take pleasure in saying it, that the management of the Exhibition has been singularly efficient, though quiet and unobtrusive. It has been felt rather than seen, and has kept everything moving regularly and in straight lines, without jar or friction. It set out with well-defined rules of action, and to these it has adhered rigidly, feeling that nothing is so detrimental to good management as change of policy.

The various examining committees are hard at work, and their reports are awaited with a great deal of interest. Their task is not an easy one, for where so many are seeking to obtain the same end by different roads, each claiming that his is the shortest, best, and cheapest, it is no easy matter to decide the question of relative merit. They have the satisfaction of knowing that they cannot possibly suit everybody, and that if they use the best judgment they have, and decide accordingly they will probably disappoint only those who are entitled to nothing better, and please those whose work entitles them to commendation and praise.

Notes at the Exhibition.

Indignation does not begin to express the feeling over here at the false and malicious charge brought against General Manager Downs, of the New England Telephone Company, and published in the New York papers. Everybody here, in every branch of electrical industry, seems to know Mr. Downs, everybody seems to like him, and everybody feels personally injured to think that such an accusation, false on its face, should gain currency. Mr. Downs was here at the Telephone Convention, saw everybody and was seen by everybody. The telegram from the West says that at that very time he was a fugitive in Europe. The proverb, "False in part, false in all" applies in this case, and no one for an instant took any stock in the charge. The only question is who it was that started such a story on its baevels, and how he can be got at. He ought to be made to suffer for it to his dying day, and, from what I know, it is my opinion that he will People whom he has deceived into believing it and giving it publicity are not going to screen him, you may be sure of that, and there are ear marks about the story which bring its origin down to very narrow limits. There's music in the air.

The managers of the exhibition are entitled to a great deal of credit for the pains they have taken to make it a means of popular education. The attendance of young people is very large, and their interest in everything they see in very great. They ask no end of questions, intelligent questions, and carry away such a store of information that the rising generation here is likely to be full to overflowing with electrical lore. I saw one flaxen-haired damsel of eighteen summers bending over the time governor for a full hour while Mr. Oram was explaining its operation to her. She seemed a little slow of comprehension, and Mr. Oram had to go over the whole story four or five times, but, good, patient soul that he is, he didn't seem to get weary at all, and I saw no cloud upon his face as long as she remained.

While it is true that the current used on an electric railway is not dangerous to life, limb, or property, it is also true that it is not pleasant to take, and that, in cases where the rails are used as conductors, it would, in street railway use, often be a cause of possible accident, in case a horse, happening to get frightened by standing on both rails at once and getting a shock, should run away and break things generally. This has got to be avoided somehow, and it seemed to me, riding up Market street the other day, and seeing them at work on the "grip" road, that possibly there might be two underground conductors, running side by side, and connected with the car by appliances on the grip principle. It may be that this idea has been all thought out, and that it is all covered over with patents which antedate my thought of it by years and years. That matters nothing. It seems to me the simplest, easiest and best way of getting over what is sure to be a serious obstacle.

By the way, I learn that the Daft Motor, which is now successfully running a miniature railway in the exhibition of the Massachusetts Charitable Mechanic Association in Boston, is to be tried on a street car in that city for a distance of several miles. The rails now down are to be used as conductors, and all that has got to be done is to connect a big dynamo, and equip the car with a motor. I am glad to see that this is to be done, for nothing does more to make a thing practically valuable than to put it to the best of practical use. In that way its weak spots, if it have any, are detected, and the opportunity is afforded to overcome them. That the road will work all right in dry weather I do not doubt, but it remains to be seen whether, when the ground is soaked with rain, and the rails actually submerged in spots, the leakage will not be so great as to render the whole thing inoperative.

Mr. Edison told me a story the other evening which is altogether too good to keep. It seems that some one more interested in electricity than versed in its nomenclature, came to him the other day and said: "Mr. Edison, I am a good deal puzzled about one thing. I have traveled a good deal, and think I know this country and England pretty well, but there is one thing that seems to have escaped me. *Where is this Wheatstone Bridge that I hear so much about?*"

Included in the Bell telephone exhibits is Prof. Bell's Radiaphone, a most interesting piece of apparatus. Its function is to transmit speech by means of a ray of light, and without wire. It consists of a flat mirror properly suspended, by means of which a ray of light is reflected through a cell containing alum water, which absorbs the heat rays, to a vibrating diaphragm about four feet distant. The diaphragm is itself a mirror, and reflects the ray back through a suitable lense to a parabolic reflector, in the focus of which is a selenium cell, the terminals of which are connected with a magneto receiver. Now, connected with the back of the mirror diaphragm referred to is a flexible tube, fitted with a mouthpiece. You talk into this tube, the mirror diaphragm vibrates, the rays which it reflects through the lens into the parabolic reflector are thereby disturbed and undergo modifications of intensity, these rays are focussed upon the selenium cell, and their changes affect the current in the cell in the same way that a vibrating armature affect the induced current around the poles of a permanent magnet. This current from the selenium cell is carried through the back of the reflector to a hand receiver, and, holding this to the ear, the speech is heard. I understand that Prof. Bell has conveyed speech five hundred feet in this way by means of a strong ray of light. Do you ask me how it is that the rays of light converged on the cell produce this effect? I don't know. Neither do I know how it is that a permanent magnet will lift a dozen times its own weight. There are a great many things that I have failed to find out up to the present time. I know that steam expands, but I can't tell why. I know that copper is a conductor and that glass isn't, but I can give no reason for it. Come to think of it, there are a heap of things in this world that we are all painfully ignorant of.

Some bright fellow has taken into his head to hang these patent fire-extinguishing grenades on hooks instead of putting them into the wire baskets in which they are ordinarily seen. When one is taken off, the hook, actuated by a spring, flies up, electrical connection is made, and an alarm is given at any desired point. It's as simple as anything can be, and yet neither you nor I thought of it.

And this leads me to say that inventors should remember to look forward and not backwards, upwards and not downward. It is natural for one, when he sees a thing which he might perfectly well have thought of, but didn't, to indulge in a little vain regret, and perhaps hate himself just a little, but it is to be remembered that the sea is just as full of fish as ever, and that the really big ones havn't been caught yet, by any means. The applications of electricity, numerous as they seem to be, are nothing in numbers to what they will be ten years hence. I fully expect to live to see electricity as common in every house as kerosene oil is to-day, and, what is more, I expect to see it generated on the premises. More than this, I expect that kerosene oil will be one of the chief factors in its production. Don't believe it? Of course you don't. I didn't expect that you would. Up in Berks County in this State they still vote for Jackson, and when you tell them that Jackson is dead, they say it is a "Whig lie." Suppose they do. Is the march of political events going to stop because a lot of folks up in the country have got left? Is it worth while to spend energy and time in trying to enlighten them. Suppose they do deny that Jackson is dead. It doesn't hurt you. Jackson don't care. Let the heathen rage. Just so it is entirely immaterial whether anybody believes it or not—immaterial to me, I mean. I know of some things that are going on, and I repeat that I expect to see electricity cheaply and safely produced in every house, and applied for lighting and power purposes, and I expect that kerosene will be a chief factor in its production. Keep your eye on that fact Dispute it all you want to. Ridicule all you can. Deny it absolutely, *but don't forget it* There are some things that are very conspicuous at this exhibition because of their absence.

Electricity has become a valuable adjunct of the police force in every city, just as it has come to be considered the chief and only sure reliance of the fire department. There are many systems of police telegraph, each of which has its advantages. I saw one to-day which had one or two novel features. There is the usual central office, and also the usual boxes at intervals along each man's beat. The scheme presupposes that the patrolman will be at each box at a specified time. When he gets there he depresses a button, and, automatically, through the operation of a switch in the central office previously set, he gets a signal telling him what box to go to. If his presence is not needed anywhere, he simply sends in a signal that he is on duty, locks up his box and goes on his way. If he needs assistance, or an ambulance, or any other of four or five things, he can call for it automatically. The whole thing is ingenious, and a great improvement on the earlier forms of police call, but wherein has it any advantages whatever of a telephone, that will permit the patrolman to talk with his chief's office at any moment? It seems to me that a box with a telephone in it covers all the ground that the best signal system does, and a good deal more. In the event of the use of the telephone exclusively, the box ought to have a good sized bell on it, which could be rung by a magneto from the central office until a policeman, or someone with a key, went and answered. Thus, in case of sending out a general alarm, all the bells would be set going. At each box somebody would hear it, and it would immediately become everybody's business to pass the word until the patrolman on the beat, if not within hearing, was notified, when he would at once go to the box for his orders. I know that a system which works very much on this principle is in operation in Chicago, and that it gives the most perfect satisfaction, but it does seem to me that some such signaling device is needed. Of course, in the case of a general alarm, where it is desired to communicate with every patrolman, a certain number of taps on the fire-bells would answer every purpose, but when, as is often the case, it is only desired to call one or a few patrolmen to their telephones, a different plan would seem preferable. A visible signal, something like those used on the railways, might perhaps do better still, because it would not disturb the neighborhood, but could readily be seen by the patrolman from a distance.

So many people have asked how it happened that the Shaw locomotive was admitted to an electrical exhibition, when there is nothing electrical about it that the exhibitors have had an explanatory card printed to answer the question. It seems that the engine of this locomotive is on a new principle, that it is balanced, that its motion is therefore regular, and that if a stationary engine were built on this principle, it would run electric lights with great regularity. Now, why didn't they build a stationary engine on this principle and set it at work running dynamos and producing lights. Then we should have known something about its running qualities. As it is it cumbers the ground and is very much in the way.

They have at last got the fountain business down fine and produce very pleasing effects every evening by means of electric head lights and sheets of colored glass; effects that compare very fairly with what may be seen at any well-regulated theater when the ballet is in progress. What they might have had, and ought to have had, was something as far ahead of this as an electric light is ahead of a gas jet. What was wanted was a fountain lighted from below, so that the light and the water would go up in columns together, producing effects which attracted thousands to the Health Exhibition in London. Nor is this all. They ought to have improved on anything and everything done heretofore. They certainly had the water and the electricity. Perhaps the other necessary ingredient, the one that the great artist used in mixing his paints, was missing.

Although it seems pretty well settled that wires made of two dissimilar metals are not suitable for conductors for telegraph or telephone currents, I find some such conductors here, with all the old claims stoutly asserted. But it is no use. The experience of the Postal Company, with its copper-coated steel wire has settled the question. Combination wires "must go."

The Restaurant is lighted by the Siemens' Regenerative Gas Lamp, an arrangment which, by securing the complete combustion of the gas, gives a very brilliant white light and throws off an intense heat. There is no vitiation of the air, because the products of combustion are carried off through a flue, which serves a good purpose in creating ventilation. The lamp is ugly and clumsy, and throws very heavy shadows. The piping necessary to carry off the products of combustion is objectionable, unsightly, and, in many cases, would be very expensive to put in. The lamps in use are said to consume about 50 feet of gas per hour each, and to give as much light as would 150 feet of gas per hour burned in the ordinary argand burners. I saw a regenerative burner in New York last week, which had the advantage of burning upside down, so that there was nothing below to cast shadows. It too had an arrangement for carrying off the products of combustion, and it gave a very beautiful, steady, white light, soft to the eye, and well diffused. These contrivances, to which the gas interest has been driven by the competition of electricity, are just now in great favor with the gas companies, which are loud in sounding their praises. They are not economical of gas, particularly. They do produce more light for a given quantity of gas used, but that "given quantity" is not less than what has heretofore been used. It is funny, in the fulsome recommendations which some of the gas presidents give of these burners, to note that they use all the arguments which have been so constantly employed in favor of the arc light.

The Exhibition has proved a great success in the matter of attendance so far as numbers are concerned, and it is clear that it is to come out on the right side financially, a matter of congratulation, certainly, for it would have been a pity if the gentlemen who have worked so hard to make it what it is had been forced to put their hands in their pockets to make up a deficiency. That there will be a surplus now seems assured, how great it will be depends of course on the attendance from this time out. Whatever it may be, it will be applied to a good purpose. But, while the attendance has been large, it cannot be denied that, in quality, it has been a disappointment to exhibitors. With a few notable exceptions the electrical men of the country have not been here, the exhibits have not reached them, and when the exhibitors pack up and go home it will be with the feeling that while what they have to show has been seen by many people, it has been examined by very few whose inspection will be of advantage in a business way, so that the question as to whether exhibiting has paid for the time and money expended is likely to be decided in the negative in very many cases. I gather this from my talk with exhibitors, who feel, many of them, that the pupils-of-the-public-schools idea, though excellent in itself, has been just a little overworked.

The city government of Philadelphia has put itself in a ridiculous position in the matter of underground wires. It has notified the telephone, telegraph, electric light and other companies, that all their wires must be underground by Jan. 1st, 1885. It has a very extensive fire alarm and police telegraph system of its own, and, to make a show of complying with its own law, it has voted to appropriate $30,000 to bury its own wires, knowing perfectly well that a round half million wouldn't accomplish the work. Such a sum it has no authority to appropriate, so that it is quite certain that when Jan. 1st comes it will be an offender against its own laws. So far as the telegraph, the telephone and the electric light companies are concerned, the thing for them to do is to shut up shop on the first day of January, and let the public see how they like it. It would be a trifle rough on Philadelphia to be cut off from telegraphic communication with the rest of the world, but the rest of the world could stand it, and Philadelphia would come to its senses in time,—in a very short time. I fancy.

I am indebted to M. Guerot, Secretary of the editorial staff of the *Lumiere Electricque*, for some valuable information. He tells me that the thing which surprises him most in this country is the extent to which electrical appliances are used by all classes of people here. In Paris, he tells me, three or four of the principal bankers have private lines of wire connecting their offices with the Exchange, but as for any such thing as a "ticker," which any one can have by paying a rental, it has never even been heard of. He tells me that, speaking generally, Paris really has no general electrical service worthy of the name, as compared with what even the smaller cities in this country enjoy. He tells me further, that Paris has no underground system, properly so called, that is, no buried conductors for general electrical works. The wires are carried in the sewers, but the sewers are big tunnels, and afford the easiest and most convenient location for the wires, which, as he quaintly expressed it, are in reality aerial wires put below the surface. I asked whether, in his opinion, it was possible to put telegraph, telephone, and electric light wires underground in a buried conductor, and his reply was absolutely in the negative. "Make galleries under your streets," he said, "and you can hang them in these galleries and work them successfully; but I have yet to see any reason to believe that they can be worked jointly when buried in close proximity to each other." Of course, we all know that telegraph wires can be worked underground, but it is at great loss of speed.

A lawyer told me the other day that it was eleven months after the Dolbear case was argued before the judge rendered his decision. If this be true, and any inference is to be drawn from it in guessing how long it will be before a decision will be reached in the present far more elaborate and intricate case, it will not pay to get excited just yet. It is to be hoped, considering the immense interests involved, that Judge Wallace will do his best to reach a decision at an early date; but, with the enormous responsibility resting upon him, he cannot be expected to hurry, and he probably will not.

Over here the trial continues to be the chief topic of conversation among the electrical people, and a great many learned and ponderous decisions are delivered every day on both sides. Quite a number of the class who make it their boast that "their money talks"—I generally find that such people lack the ability to talk to any purpose with the organs usually devoted to that purpose—are to be found here, and whether you want to put your money on the complainant or the defendant, you can be accommodated.

The little electric railway is actually running at last. Its track is only one hundred feet long, and it is a very diminutive affair, its little car carrying not more than five or six passengers at most. But "it moves"—slowly, it is true—but yet "it moves," and attracts a great deal of attention.

Telephonic News

*** The gross output of telephones by the New England Company in August was 245, and the net increase 100, making 18,765 sets of instruments in use September 1.

*** English telephone companies are to be licensed to make connections with the postal telegraph offices. This will enable subscribers to the telephone companies to telegraph to any part of the United Kingdom without extra charge.

*** The work of placing telephones in the different fire stations of the city of Montreal, and connecting them with the central fire alarm office, has just been completed. It is understood, however, that the telephones are to be for the use of the brigade alone.

*** The net output of instruments by the American Bell Telephone Company for the month ended September 20 was 1,374, against 616 the previous month, and 4,365 in the corresponding month of 1883. The net gain for seven months of the fiscal year is 21,594, compared with 39,657 in 1883.

*** The Palmer Wire Company, which manufactures special telegraph and telephone wire and wire goods, on Monday voted to increase its capital stock $50,000, making a total of $200,000. This company's business has increased largely during the past year, and the superior quality of their wire has gained for them a strong foothold in the telephone field.

*** The journals of this district report that the *Societe Generale des Telephones* has ceded to the French Government the telephone system that they laid down in Lille five years ago. It appears that the inhabitants object to this arrangement, as they fear they will not be so well served by Government management. They even threaten to boycott the telephone if their claims are not attended to.

*** "Why is it that the employes in telephone offices are all ladies?" Mrs Brown made this inquiry of her husband. "Well," answered Mr. Brown, "the managers of the telephone companies were aware that no class of employes work so faithfully as those who were in love with their labor, and they knew that ladies would be fond of the work in telephone offices." "What is the work in a telephone office?" Mrs. Brown further inquired. "Talking," answered Mr. Brown, and the conversation came to an end.

*** The Clay Southern Telephone Company filed its certificate of incorporation September 20 in the County Clerk's office. It has a capital stock of $250,000, divided into 2,500 shares of $100 each, with the right to increase it to $500,000, if it should be deemed necessary. The corporators and directors of the company and the number of shares held by each are: William F. Lett, 600 shares; Seth R. Beckwith, 600 shares; George W. Palmer, 600 shares; Alfred W. Jones, 600 shares; and Ovide Dupre, 100 shares. This company, like the Clay Telephone Company and Overland of Philadelphia, will probably do little beyond working the usual stock racket of loading up the lambs.

*** The surplus receipts of the Intercontinental Telephone Company at Caracas and La Guayra in August were $1,637.27, and the company had 325 paying subscribers and a cash surplus, September 1, of $6,000. This will it is expected, be increased to $12,000 by January 1. With this it is proposed to build a similar plant to the above at Valencia and Porto Cabello, 80 miles from Caracas, and so situated as to call for a trunk line between the cities. The Caracas-La Guayra trunk line is very profitable. This complete, the company will have a plant of $40,000 in and between the aforesaid cities. Net earnings are expected to begin flowing towards Boston early in 1885.

*** Mr. E. C. Dickerson made the closing argument in the contest between the American Bell Telephone Company and the Drawbaugh Telephone Company this week. The prevailing impression gained by those who have listened to the arguments seemed to be that the American Bell Telephone Company's case is an exceedingly strong one.

*** The central telephone office at Munich was opened on May 1, 1883, with 144 subscribers, and at the end of last July the number had increased to 417. The subscription price is about 200 francs per year. The central office is open from 7 A. M. till 10 P. M. There are two central offices, connected by thirty trunk wires. The apparatus used consists of the Ader microphone with the Bell receiver, and the Western Electric Manufacturing Company's tables. Each subscriber has a battery of four to eight Leclanche cells to call the central office.

*** The New York and Pennsylvania Telephone Company are doing the largest trunk line business of any company except the New England and Central Union. They have continued to construct new lines during the past year, and we are informed by Assistant General Manager Conn and Superintendent Stearns (who recently paid our office a visit) that they are pushing this branch of the work ahead at a more lively pace than ever before. There is nothing that will tend to strengthen the hands of the present companies now controlling the telephone field more than to have a good system of trunk lines as well as a perfect exchange system. Should the opposition by chance get into the field, they will have little to fear.

*** Some interesting experiments in telephonic transmission have been made at the Eastern Railway station at Antwerp on the first of this month, and *L'Opinion*, of that city, gives an account of them in the following terms: "We heard as distinctly as though we had been fifty paces from the performers, two pieces played at the concert at the Vauxhall in the Park at Brussels—a Meditation of Gounod, and a fantaisie on the *motif* of "Le Prophete." The sounds of the stringed instruments were given with the greatest purity; the wood instruments left a little to be desired as to sonority, but that arose, according to the explanation given to us, from the installation of the orchestra, and it will be easy to correct that fault. The brass instruments acted well and without unreasonable clatter. As to the big drum and the kettle drums, we did not hear them at all. Is it because they are rebellious to telephonic transmission? However that may be, the result is marvelous, if we consider that the Vauxhall concerts are given in the open air, and especially that during the transmission of the music of Gounod and Meyerbeer the wires were in use at the same time for ordinary telegrams between Brussels and Antwerp."

*** London telephone interests have brightened since the Postmaster-General has announced his intention to issue licenses in conformity with the concessions offered by him in a recent debate in Parliament. It was proposed that every telephone company should pay a certain royalty on all its business, in return for the advantages they would enjoy. But that claim is now abandoned so far as the use of private wires is concerned, this concession being one more than Mr. Fawcett had proposed. Still another concession is the permission to the companies to connect their systems with the post-offices, so that subscribers may transmit telegrams direct from their own telephones without extra charge. The Post Office Department still retains the right to carry on telephone business on its own account, as well as to issue whatever new licenses it may think fit. It forbids any telephone company to receive or deliver a written message, in order that all danger of infringing its telegraph monopoly may be avoided, and charges a percentage on gross receipts, except, as just mentioned, those of private wires. While occupying the position of a monopolist in the matter of right of way over the railway lines, and of a competitor for telephonic business, it denies all obligation to lease a right of way or to put up lines for the companies.

*** What is claimed to be a new invention in telephonic science has lately been described by Dr. R. Lenz in the last "Bulletin" of the St. Petersburg Academy of Sciences. The object in view is the measurement of temperature at a distance. Let us imagine two stations, *A* and *B*, connected together by an iron and a silver wire, which are looped together at both stations. If the looping at *A* has a different temperature to that of *B*, a thermal current will circulate through the wires; and if a silent interrupter and a telephone be introduced into the system, the telephone will emit a sound, which will cease immediately the observer at *B* has raised or lowered the temperature of his looping place, so as to render it equal to that of *A*, and to destroy thus the thermal current. The exactness of this method depends on the exactness of determination of the moment when the lull ceases in the telephone, which moment is influenced by a remnant of lull in the instrument after the equalization of temperature at both ends of the apparatus. In a series of experiments where the points *A* and *B* were one meter distant, Dr. Lenz determined temperature by this method with great accuracy, the errors being only from 0.01 deg. to 0.17 deg.; and he concludes that, by using ironargentan wires two millimeters thick, the measurements could be made at a distance of five kilometers, which distance, we believe, could be still further increased, say, to as much as twenty-five kilometers, if antimony and bismuth wires were used.

*** On the subject of placing the telephone wires underground in Philadelphia, President Henry Bentley recently stated that the result of such an enormous expenditure would put the cost of telephones and telegraphing beyond the reach of people of ordinary fortune. The connections to be made with business houses would be very costly also; and would have to make a big item in the first charges for the instruments. "The idea seems to be," said Mr. Bentley, "that the conduits will be laid along the streets like gas pipes, and that trenches will be dug and connections made with every house where they are wanted. In some places near the central offices, this could be done at a reasonable cost, but where we have but a few subscribers in a block, a telephone would be as much a luxury as a team and carriage. Practically, our business would be broken up. And then another thing: suppose, after we get the wires underground, we find the conduits are of no use. They are all highly recommended, I know, but none of them yet have stood the business test of a few years' working, and, to tell the truth, I don't think they will. There is the Brush Electric Light Company, which went to the expense of putting down a costly English conduit on Delaware avenue. A few days ago they found that the intense heat of the electric current had melted the sand all around a loop in the wires, and that lumps of glass had formed six inches in diameter. Suppose that current was within a few feet of the telephone wire conduits. The light current that the telephones need would be made of no service whatever. Telegraph wire conduits would have to be placed some distance from the electric light wires, and then the protection would be only partial, because of the frequent pressure of conducting materials in the ground between the two. To reach buildings on each side of the street, the electric light wires would have to be crossed above or below, and then another serious difficulty would take place. I know, and any practical electrician will tell you the same, that the whole subject is so full of difficulties that to talk about taking all the wires down at the 1st of January is absurd

"As far as our companies are concerned, we are as anxious to get the wires underground as the people, and we have no disposition to do anything else than accede to the people's wishes in the matter. Poles, fixtures, etc., are becoming so expensive that we must make some change for our own protection, and we will do it most willingly just as soon as we can. In the meantime we propose to protect our property. We can't comply with the terms of the ordinance, and we will go into the courts as soon as the city makes a move against us; then, I think, we can make a good stand. We have acquired rights and privileges from the city; we have paid for them, and our taxes are among the heaviest paid. The courts, I think, will recognize our rights."

Rights of Opposition Lines—Hearing Before the Railroad Commissioners.

The railroad commissioners gave a further hearing in Boston on Friday last, on the resolve passed by the legislature instructing the board to investigate the subject of the occupation of railroad locations by more than one company organized for the purpose of transmitting intelligence by electricity, etc. President Choate appeared for the Old Colony road, Mr. Torry for the Fitchburg, Superintendent Furber for the Boston & Maine, Mr. Olney and Mr. Stevens for the Eastern, the Hon. William G. Russell for the Fitchburg, Judge Soule and Superintendent Barnes for the Boston & Albany. Parker Chandlers, Esq., and Mr. Bates appeared for the Baltimore & Ohio Telegraph Company, or generally for the opposition lines.

Mr. Choate, being invited to address the board, said he regarded telegraph poles on a railroad line a nuisance, so far as they were not absolutely necessary. The fewer there were the safer it was, and they should be absolutely under the control of the railroad company. The idea of allowing any telegraph company to go on a road with its own men and put up its poles, and then to hold the railroad company liable for any damages that might occur, was perfectly preposterous.

Mr. Chandler said there had been many attempts to establish opposition telegraph lines. They had failed because the Western Union Company had been able with its great wealth to squelch the weaker lines; because the new companies had met, also, the combined opposition of the railroads; and, thirdly, because of the knowledge of the public of the opposition of the railroad lines, it has been difficult to make business contracts, people being timid about incurring the enmity of the old telegraph company, lest, when the new companies should be absorbed, the old company should discriminate against those who had left them. The Baltimore & Ohio Company, starting in connection with the railroad, had succeeded along its own line and was now a strong corporation. It was now behind the movement to rid the community of the great impediments to cheap telegraphy, namely, the opposition of the railroad companies. Mr. Chandler argued that the practical danger from the location of telegraph poles along lines of railroad, as shown by evidence before the legislative committee last winter, was very slight. He thought, as an engineering question, it was certainly open to argument that three lines of poles, bound together with iron bands, would be as little likely to fall as poles in a single line; and he suggested that the mass of wires might be brought into the city over iron arches till within a mile of the central office, from which point they could be carried under ground. It was useless, he said to make any argument in favor of cheap telegraphy to the public, because its advantages were so well known. Some of the railroad companies had declined to transport materials for opposition companies at as low a rate as for the Western Union, and absolutely refused to deliver materials between stations, therefore the opposition lines could not be built along the line of the railroads, even just outside their locations, and were forced to go upon the highway, where, again, the violent opposition of the citizens was met. Mr. Chandler then considered the exclusive contracts between the railroads and the Western Union Telegraph Co., arguing that they were illegal and that, therefore, need not be regarded by the commissioners. Any law granting all telegraph companies the same rights that anyone has in the railroads, so far as compatible with public safety, would be constitutional.

Birth of the Telegraph.

HOW PROF. MORSE FELT BEFORE HE BECAME FAMOUS — AUTOGRAPH LETTERS OF TWO-SCORE YEARS AGO, RECITING THE GREAT INVENTOR'S HOPES AND AMBITIONS.

Two autograph letters written in 1842 by Prof. S. F. B. Morse on the eve of his great electrical success, we give herewith. They have never before been printed, and contain much of interest relating to the famous inventor's early struggles, hopes, and plans. The letters were addressed to the late Judge William W. Boardman, of New Haven, who, in 1842, was a member of Congress, and who, as the especial friend of Prof. Morse, did a great deal to advance the interests of the electrician and secure legislative recognition for a project which at that time was generally accounted visonary. This was the first letter, extending thanks for favors, and reciting the inventor's ambitions:

NEW YORK, March 7, 1842.

MY DEAR SIR:—I intended long since to have written you and thanked you for your kind attention in relation to my telegraph, and for your resolution of inquiry. Please now accept my thanks. I have been constantly occupied this winter in simplifying some parts of the mechanism, and had hoped to have everything complete to show it in Washington this session. I still may be able, but dare make no promise, knowing full well from experience the baffling and protracting nature of invention. My instrument is much more complete than it has ever been, and if in its ruder state it created so much interest, I feel confident of a greater when the perfect instrument is seen. I have just received a letter from Prof. Henry, of Princeton, which I copy for your perusal, and with a view of having it handed to the committee. I need not say to you that Prof. Henry has a higher character as a philosopher and a discoverer in the department of electricity and electro-magnetism than any man in our country, and there is no man of the present age who stands higher in Europe in this particular department. You may recollect it was Prof. Henry who first successfully caused the magnet to hold suspended 2,000 pounds, and invented the first magnetic engine. With regard to the resolution of inquiry before the Committee of Commerce may I ask the favor of you to have them suspend action upon it until I can show the telegraph in Washington, unless they are disposed to report the bill reported by the former committee. If they are ready to do this without seeing the operation of the instrument, very well. I shall then be able to show them a more extended application of its power the next session. But if they are not ready and should report it inexpedient it might injure my operations next session. The following is the copy of Prof. Henry's letter:

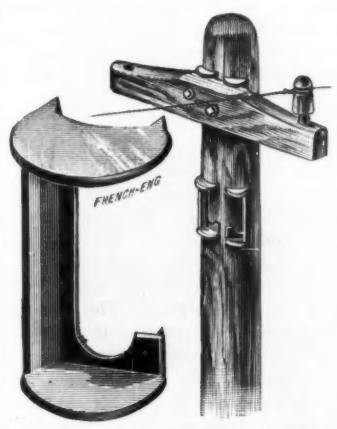
PRINCETON COLLEGE, Feb. 24, 1842.

Prof. Morse:

DEAR SIR:—I am pleased to learn that you have again petitioned Congress in reference to your telegraph, and I most sincerely hope that you will succeed in convincing our Representatives of the importance of the invention. In this, however, you may perhaps find some difficulty, since, in the minds of many, the electro-magnetic telegraph is associated with the various chimerical projects constantly presented to the public, and particularly with the schemes so popular a year or two ago for the application of electricity as a moving power in the arts. I have asserted from the first that all attempts of this kind are premature and made without a proper knowledge of scientific principles. The case is, however, entirely different in regard to the electro-magnetic telegraph. Science is now fully ripe for this application, and I have not the least doubt, if proper means be afforded, of the perfect success of the invention. The idea of transmitting intelligence to a distance by means of electrical action has been suggested by various persons, from the time of Franklin to the present; but, until within the last few years, or since the principal discoveries in electro-magnetism, all attempts to reduce it to practice were necessarily unsuccessful. The mere suggestion, however, of a scheme of this kind is a matter for which little credit can be claimed, since it is one which would naturally arise in the mind of almost any person familiar with the phenomena of electricity, but the bringing it forward at the proper moment, when the developments of science are able to furnish the means of certain success, and the devising a plan for carrying it into practical operation are the grounds of a just claim to scientific reputation as well as to public patronage. About the same time with yourself Prof. Wheatstone, of London, and Dr. Steinheil, of Munich, Germany, proposed plans of the electro-magnetic telegraph, but these differ as much from yours as the nature of the common principle could well permit, and unless some essential improvements have lately been made in these European plans I should prefer the one invented by yourself. With my best wishes for your success, I remain, with much esteem, yours truly,

JOSEPH HENRY.

Thus you will perceive that Prof. Henry accords precisely in opinion with the committee of the French Government which examined both Wheatstone's and Steinheil's in connection with mine, and gave the preference to the American. I cannot doubt, when the subject is fully understood,



PORTABLE AND ADJUSTABLE CROSS-ARM HOLDER.

that our Government will appreciate the importance of this invention. The mind may speculate very freely on the revolution which the instantaneous interchange of thought from one part of the country (I may say of the world) to another has effected, and although to one who is ignorant of the nature of the invention, these speculations may seem the vagaries of a prurient imagination, the reality will still outstrip his conceptions. I ask my Government for aid in giving this invention to the world, and demonstrating its American origin and perfection. Will they do it? If thought advisable in the existing state of the finances of the country to appropriate a less sum than is asked for by the bill formerly reported, a less sum, say $15,000 or $20,000, would give the invention a sufficiently extensive trial on which to found future legislative action. I leave the subject to the wisdom of Congress. I have written on the subject (some weeks since) to several friends in Washington, to whom, if you are so disposed, please show this letter—to Mr. Barnard, Mr. Winthrop, Mr. Cushing, Mr. Granger, and any others—at your convenience and pleasure. With sincere esteem, your friend and servant,

SAMUEL F. B. MORSE.

The Hon. William W. Boardman.

Nine months later the following letter was written by the devoted inventor, evidently in a confidently hopeful mood:

WASHINGTON, Tuesday, Dec. 14, 1842.

MY DEAR SIR:—My telegraph is in fine order this morning and established between the Committee of Commerce of the House and the Naval Committee of the Senate. I shall be happy to show its operation to any of the gentlemen of the House whenever it suits their convenience. Truly, with respect, your friend and servant,

SAM. F. B. MORSE.

Portable and Adjustable Cross-Arm Holder.

Cutting into telegraph and telephone poles for the purpose of fastening on the usual cross arm necessarily weakens the poles, and permits the retention of moisture, which tends to rot the wood; it is also a slow and tedious job To obviate this, Mr. William Kline, of Toledo, Ohio, has devised a portable and adjustable cross-arm holder, a cut of which is given herewith. It presents numerous advantages, among which may be noted the fact that with it the cross-arm may be raised or lowered without disturbing the wires. It does away with braces. Those who have used it, and found out its many conveniences, are loud in their praises of its value, and recommend it highly.

.... The postal and telegraphic congress, which was to be held in Lisbon during the month of October, has been postponed until February next on account of the presence of the cholera in Europe.

.. The difficulty between the United States and Dominion Governments regarding the landing of a cable by the latter at Point Angelos, Washington Territory, to connect with the British Columbia telegraph system at Victoria, has been settled, and the necessary permission obtained. The superintendent of Dominion telegraphs leaves on Monday for the Pacific coast to carry out the work. It will be remembered that the Dominion Government refused similar permission to the United States Company some time since.

.... *L'Electricite* gives the following list of submarine cables laid in France since 1878 by the French Minister of Posts and Telegraphs, forming, with the subsidiary submarine communications for completing the coast lines, an increased length of 3,210 kilometers (1,990 miles), or an average of 535 kilometers (330 miles) of new cable yearly: In 1878, a direct line between France and Corsica; in 1879 and 1880, two new cables between Marseilles and Algiers; in 1881, a cable between La Calle, in Algeria, and Bizerte, in Tunis; in 1882, one between the last-named place and Bône, in Algeria; and a series of cables on the east coast of Tunis, between Soussa, Sfax, Gabes, Djebba and Zarzis.

... Mr. J. Halisz, chief electrician of the Gallician railways, has designed a new arrangement of the ground plates of telegraph lines. He places a bed of coke of medium thickness in a hole two meters deep and of one square meter surface, and on that bed a tube of wood of thirty-eight centimeters section, filled with coke and surrounded with earth. At the upper part of the tube is placed a block of coke, previously plunged in melted lead: this block is itself attached to a copper rod, which communicates with the telegraph line. This arrangement allows the gas which may escape from the soil to pass freely into the air, and so avoids the resistance opposed by the gaseous film which sometimes forms on the surfaces of earthplates.

.... One of the telegraph lines, whose regular route has been interrupted by the Franco-Chinese operations at Foo-Choo, in announcing an alternative land route, intimates that messages must be written in plain English, the use of code words being forbidden. How gladly, says the *Pall Mall Gazette*, would all our great trunk lines of telegraph, land and submarine, make a similar restriction. Few persons outside the management of the lines realize to what an extent code words interfere with the profits of the telegraph. Some twelve months ago, at one of the meetings of the Eastern Telegraph Company, Mr. Pender, M.-P., the Chairman, told his shareholders that one of the most serious facts that telegraph companies had to face was the extension of the system of the use of code words. From coining short words to represent long words charged for as two, the practice had been extended in the most elaborate style, and now short words frequently stand for a phrase and sometimes for a whole sentence, and the profits of the telegraph were correspondingly reduced.

TELEGRAPHIC

.... A novel entitled "A District Messenger Boy" has appeared. Like its prototype, it probably will not run very long.

.... The receipts of the English telegraph department from April 1 to August 30, in the year 1884, were $3,775,000, against $3,751,000 for the same period during last year.

.... *L'Electricite* says that there are at the present time 7,702 Morse instruments at work in France. The Baudot apparatus, which works between Paris and Marseilles, transmits 1,800 messages per diem.

.... The Indo European Telegraph Company announces that the government telegraph station at Fungchow has been transferred to Pekin. The company can therefore transmit dispatches direct to Pekin in place of sending them by way of Fungchow.

.... The English maritime council has decreed that all telegraph ships occupied in laying or repairing cables must carry three globular lanterns at night, each one of at least ten inches diameter, placed in a vertical line one above the other, the upper and lower lanterns to be red and the middle one white.

.... The proposal of an Australasian syndicate to lay an ocean cable from Brisbane to San Francisco has been favorably received by the Hawaiian Legislature, and a report in favor of granting a subsidy of 20,000 dols. (£4,000) per annum for fifteen years promptly passed the third reading. This syndicate also proposes to lay a cable between California and Queensland.

.... It was agreed on Thursday last between all parties interested in the Bankers and Merchants' Telegraph Company, who had appeared in court on the question of who should be appointed receiver of the company, that two receivers should be appointed. The gentlemen named as such are James G. Smith and Richard S. Newcombe. Judge Donohue granted an order appointing them.

.... By virtue of an arrangement of the Chinese administration of telegraphs, since September 1 all private dispatches coming from France and forwarded by the land lines must be written in English. Commercial telegrams in cipher are not accepted. These restrictions do not apply to the dispatches of the neutral governments, nor to those forwarded from Shanghai, Amoy, and Hong Kong.

.... Correspondents of English newspapers in Egypt complain loudly of the delays caused by the administration of telegraphs in the transmission of dispatches, which take three days to go from Wadi Halfa to Cairo. The Reuter agency also complains of the fashion in which the telegraph service is performed in Egypt, and believes that the native employes are incapable of handling the large increase of business which is now imposed on them.

.... Since the 15th of last August Austria possesses one of the longest tunnel cables in the world, and, after two weeks' work, the ends of the cables have been brought to the building specially put up for them at Langen, near Arlberg. The government had accorded a sum of 94,000 florins for this work. The cable is composed of twelve conductors, of which six are intended for the State telegraph service, three for the railroad telegraph, and the three remaining conductors are kept in reserve as spares. Each conductor is composed of seven very fine copper wires plaited together and surrounded with gutta-percha. Then comes a thick covering of hemp soaked in tar, around which are enrolled in a spiral form eighteen well galvanized iron wires. Last of all comes a cotton tape strongly impregnated with tar. The cable has a total length of 10,270 meters, and weighs nearly 80,000 kilogrammes. It is furnished at the two ends, at St. Antoine in Tyrol and at Langen, with lightning arresters of a new pattern, as a guarantee against all injurious effects of atmospheric electricity.

ELECTRICAL AND SCIENTIFIC

* * It is claimed that the latest discoveries render insulation so perfect that to-day there is less loss of electrical force between the United States and England than there was formerly between New York and Brooklyn.

* * George W. Weaver, of Ilion, N. Y., publisher of the Ilion *Citizen*, is printing the first newspaper in the world the type of which was entirely composed by a type-setting machine. The entire edition of 5,000 is being printed by power from an electric motor, the same which on March 14 printed Mr. Weaver's *Journal*, being the first daily in the world to accomplish the feat.

* * During the recent meeting of the American and British Associations a proposition was brought forward for the organization of an International Scientific Association, to meet at intervals in different countries of the civilized world. It came in the shape of a petition signed by eight past presidents of the A. A. A. S., and many members of both associations. The matter was referred to a committee from the British Association, consisting of Sir William Thomson, Sir Lyon Playfair, and Vernon Harcourt; and from the American Association a similar committee was appointed, namely, Professors Newcomb, Hunt, Barker, Pickering, Powell, Remsen, and Minot. The joint committee will confer and report hereafter. The idea meets with very general approval.

* * The six subterranean chambers at the Paris Observatory, for securing a uniform temperature, in order to study the earth's magnetism, have just been completed. The internal dimensions of each are 60 meters by 16 meters; and the walls, of concrete and millstone grit, are 1 8 meter, or 6 feet thick. Inside the space thus formed come the inner chambers, isolated from the outer by a gallery 2 meters wide; the inner walls, of similar construction to the outer, by 80 centimeters, or nearly 3 feet, thick. The height of the chambers is 3.65 meters = 12 feet under the crown of the arch, which is a meter thick, covered with earth to the depth of 2 meters, turfed and planted with shrubs. The observation chambers are destined to receive the following instruments: Recording apparatus of magnetic variations; Lamont's instruments for direct observation, and Arago's appliances. Strange to say, gas has been adopted for illumination.

* * Prof. George Forbes, of London, delivered a lecture in the lecture-room attached to the Electrical Exhibition last Friday, on "Dynamo-Electrical Machinery," to an audience that filled every seat in the large room. His remarks were necessarily largely confined to the elementary principles of electricity, and a large part of his allotted time had expired when the lecturer reached that part of his remarks referred to in the title.

At the beginning of the century, began Prof. Forbes, our information about the action of electrical currents was very limited, and it was not until a remarkable discovery was made in 1820 that the foundations of that knowledge were laid which have culminated in the many machines seen in the exhibition.

We knew for one thing at the beginning of the century that when zinc was placed in a jar of slightly acidulated water, and copper or carbon was placed in another jar, and the two metals connected by a wire, a current of electricity would pass through it. The passage of electricity the lecturer compared to the passage of heat through a wire. It is a sort of molecular change.

The professor then went on to trace the early history of electricity until Oerstid's discovery of the connection between magnetism and electricity by means of the magnetic needle and the influence a current of electricity had upon it, turning the north point westward. This, he claimed was the foundation of all future researches in dynamo-electricity. He told how a magnet could be made of a bar of iron by coiling a wire about it and then sending a current through the wire.

The Electrical Development and Manufacturing Company.

This company is now fully equipped with a large and costly plant of the very best machinery, all set up and in operation, and with experimental and working laboratories arranged on the most comprehensive and systematic scale. Its business covers the manufacture and sale of every kind of electrical device and apparatus, either under patents owned by itself or by its patrons, and the assisting of inventors and discoverers in the development and perfection of their inventions, and giving them commercial value. An important part of the company's work, incidental to its general business, will be the making of accurate and delicate tests for inventors, manufacturers, and others, by means of costly apparatus provided specially for the purpose. The need of an institution of this sort has long been felt. Inventors, as a rule, are not only too poor in pocket to supply themselves with the necessary appliances for carrying on their experiments, but also devoid of that knowledge of business which is requisite to secure to them the just fruits of their work. In the establishment of the Electrical Development and Manufacturing Company they will find not only fully-equipped workshops, and laboratories fully supplied with all apparatus which can possibly be required, but also legal and business advisers, skilled on the one hand in obtaining patents and on the other in pronouncing upon the value of an invention, and in determining the best and most expeditious means of getting it upon a paying basis. Of course it is not the province of the company to do all this for nothing, but the pay will come out of results and not out of the pocket of the inventor at the start. We would recommend all inventors who have in hand inventions or discoveries which they believe valuable, but which they have not as yet been able to realize upon, whether patented or not, to communicate with the Electrical Development and Manufacturing Company, at 197 Congress street, Boston, and state their case. It cannot do them injury and it may result in doing them great good.

The Stanley and Thomson Incandescent Electric Lamp.

At the International Electrical Exhibition, at Philadelphia, the annex is mostly illuminated by what are hereafter to be called and known as the "Stanley and Thompson lamps," so called according to a legal agreement between the inventors, William Stanley, Jr., and Edward P. Thompson, executed at the time of the purchase of the invention by Geo. Westinghouse, Jr., of Pittsburgh.

In the circulars issued and widely distributed by the Union Switch and Signal Company, manufacturers of this lamp, the Stanley and Thomson lamp is described under a name not agreed upon by both of the inventors.

The inventions in this lamp comprise principally that of the method of manufacturing the carbon filament from a new chemical preparation, and the process of carbonizing several hundred horseshoe-shaped carbon filaments simultaneously in the space of five or six cubic inches; while the advantages claimed refer to the high specific resistance and uniformity of structure of the carbon filaments, and simplicity and cheapness of manufacture.

American Electric and Illuminating Company.

The business of the American Electric and Illuminating Company has had a very rapid and substantial growth. It consists in constructing electric light plants entire in cities and towns where there seems to be a demand for them, getting them into practical operation, and then, when their success is assured, selling them out to local companies. The company uses exclusively the lamps and dynamos of the Thomson-Houston Company, of which it may safely be said that, for economy, steadiness, and brilliancy, they have no superior. These dynamos and lamps, combined with the other appliances and methods which experience has shown to be the best, constitute what is known as the "American System," a system which is now in successful operation in a number of cities. The announcement of the company will be found in our columns to-day, with full particulars, and list of officers. The company has published a very interesting pamphlet, replete with valuable information to all who are, or expect to be, concerned in electric lighting, and giving every possible detail concerning the past work of the American Electric and Illuminating Company. This pamphlet will be sent free to any address, and will be found to be a book worth reading and preserving. Those who desire to have a hand in introducing the electric light into the cities or towns in which they reside, should make it a point to write to the American Electric and Illuminating Company before making their selection, and at least informing themselves concerning this system. The American Company "points with pride" to the record of numerous lighting companies which have grown out of its work, companies whose business is far more extensive than the most sanguine thought possible at the start, and whose profits take the shape of very satisfactory dividends to the stockholders. The American Company is fully equipped to do a very large business, and its construction force is so thoroughly organized and experienced that it can establish a plant in a substantial manner in a very short time. Despite much that has been said to the contrary, electric lighting from a central station can pay and does pay with proper management in any city or town of reasonable size, and there is every reason to suppose that the next five years will see an enormous increase in the use of electric lights throughout the country. Of this increase the American Electric and Illuminating Company seems, from the enterprise and vigor of its management, sure to get at least its fair proportion.

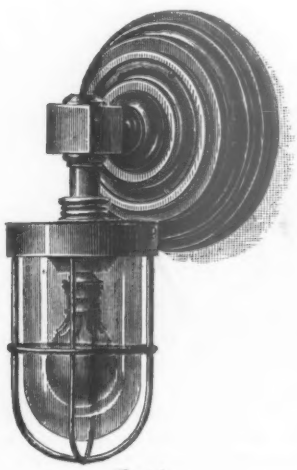


FIG. 4.

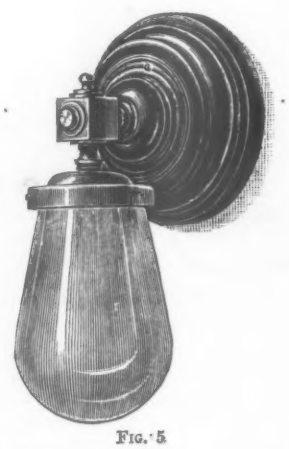


FIG. 5.

BRUSH ELECTRIC LIGHT FITTINGS.

The Victoria Dynamo Machine.

No collection of electric lighting plant would be complete unless it included specimens of the Brush manufacture. This company was one of the first in the field, and has attracted more public notice than any other—perhaps more than all others put together. In the early days of electric lighting its success was most rapid, and the reason was not difficult to find. Its plant could be safely put into the hands of unskilled men, and could be relied upon to give satisfactory results with a very meager amount of attention. The lamps contained neither springs nor clockwork, and could be placed in exposed and dirty situations without fear that a little dust would upset their action. The system of one circuit was also a great recommendation, as users could easily comprehend it, and could move their lamps to suit their requirements without fear of damaging their apparatus by improper arrangements. A comparison of a Brush installation with any of the others which existed at the time the system was introduced into this country showed at once the reason of the hearty appreciation it met with. It was seen at once that the inventor was perfectly free from any professional traditions, and throughout his design he had kept in mind the conditions under which his apparatus was to work, and the class of people in whose hands it would be placed.

The Brush dynamo was early distinguished by its good workmanship and the high potential at which it could be safely worked, thanks to its perfect insulation and the form of its commutator. Indeed, the employment of a current of high electromotive force formed the key-note of the system, allowing of great simplicity of arrangement and an important economy in the cost of leads. In a system of town lighting in which four machines of the newest type are used, each feeding 60 lamps in series, spaced 80 yards apart, it is possible to light twelve miles of streets from a single center. Now, if the potential of the current were reduced to a point at which it could only maintain twelve lights in series, there would be five times the length of lead required, and the first cost, at £70 per mile, would be increased from £770 to £2,940, while the expense of laying and jointing would go up in the same proportion. Mr. Brush was always ready to defend his plan against those who decried it on the score of danger, and he has recently made an improvement in the armature of his dynamo by which he is enabled to increase the number of lamps in series by 40 per cent., while at the same time the efficiency of the generator is augmented 10 per cent. One of the new machines is shown at the Health Exhibition. It is of the size originally known as a 16-light dynamo, but it is feeding 23 lamps arranged in a circuit.

The construction of the new armature core is shown in Figs. 1, 2 and 3, where it will be seen that it bears a general resemblance to the original core, but that instead of being cast in one piece it is built up of thin wrought iron plates. It is formed of a long strip or band of iron, and a large number of **H**-shaped plates (Fig. 3); the band is wound in a spiral round a foundation ring A^1, and the **H** pieces are placed between its convolutions to inclose spaces *B*, in which the coils of insulated wire are wound. The parts are bound together by rivets *r* (Fig 2), which pass from the outer to the inner circumference. The ring is mounted upon a gun-metal boss with three arms, which are secured to the inner periphery of the core, and hold it in position with regard to the axis. It is found that with the new construction the heating effect is greatly decreased, while the enormous surface exposed to the air allows a rapid ventilation, which keeps the temperature very low. The practical effect of the invention is that for the same outlay a machine can be manufactured to run 55 to 60 lights, instead of 40, as formerly.

In addition to the arc lights, the Brush Company exhibit 200 incandescent lamps driven by a pair of Victoria dynamos, one actuated by a Tower spherical engine, and the other by a Parsons engine. This generator, a very fine example of which is illus-

trated above, has already been described by us, but since the date of our notice it has received considerable improvement. It is made in two patterns, one with four magnetic fields, and the other with six. There are, of course, as many neutral points in the commutator as there are magnet poles, and originally there was a brush at each neutral point; but, by a method invented by Mr. Mordey, one of the company's engineers, all the brushes, except one pair, are dispensed with, and the difficulty and complication which formerly existed are avoided. The invention consists in connecting to one another all the coils, or all the commutator segments, which are of equal potential. Supposing there are six poles, as in the figure, it is evident that the coils of the armature may be divided into three groups, all of which are under similar conditions. The first coil of No. 1 group will always be traversed by a current of equal potential to the current of the first coil of No. 2 or No. 3 groups, whether the coil be advancing towards or receding from a pole, as all the others will be similarly situated, and consequently these coils may be joined by cross connections between the wires which couple them to the commutator segment. The same thing is true of the second, third and fourth coils, and of all of them. Now let us return to the first coil, and imagine it to be approaching a neutral point between two poles. The corresponding commutator segment should be in contact with a brush (say, the positive brush), and so would the segments corresponding to the first coils of No. 2 and No. 3 group. But, since all these three coils are connected together, the current from each other can flow directly to the respective commutator segments, or the currents from groups 2 and 3 can traverse the cross connections and flow to the commutator segment of the first group. If there is only one positive brush, this is what happens, and all the current escapes at one segment. When the first coils approach the next neutral point, the brush will be over the segment corresponding to the second group of coils, and this will now serve also for No. 1 and No. 3 groups, and so on, each segment in turn receiving the current from three coils and performing the office with two other segments filled, when three pairs of brushes were used. In addition to its simplicity, the Mordey method of connecting up multipolar machines has the advantage of allowing the brushes to be placed in an accessible position, for out of the original six brushes any pair of positive and negative terminals can be retained—that is, they can be separated by either 60 deg. or 180 deg., as found most convenient.

The armature is of the ring type, and is wound Gramme fashion with coarse wire. The pole-pieces are in the form of jaws, which embrace the disc, and are mounted on wrought-iron bars, which constitute the magnet cores, and serve to bind the two sides of the machines together. These bars have large collars where they abut against the frames, and when they are screwed up the structure is perfectly solid, and does not require a bed-plate. The width of the pole-pieces is not so great, as experience has shown that if the space between them is large the neutral point is very accurately defined, and does not extend beyond one segment of the commutator. The result is that sparking is almost obviated, and a current of several hundred amperes can be taken off nearly imperceptibly, while the brushes can be set radially, instead of tangentially, as usual. From a practical point of view, this latter is a great advantage, as the wear takes place on the end of the wires instead of their sides, and consequently they do not become uneven or ragged. The brushes are arranged in pairs, so that they can be renewed, it need be, without stopping the machine, and the details of the holders have been very carefully designed.

The two brush holders are carried upon a double bracket, capable of being rotated round the commutator to find the best position, and the commutator segments are made very thick, so that they can be turned up many times should they be cut. The current is led off by flexible conductors to insulated studs in the frames, and, passing to the inner side, it traverses the coarse coils of the field magnets, and then returned to the main terminals of the machine. The fine coils of the compound winding have independent terminals not shown in the figure, so that the current may be sent through them or not, as desired. The machine we illustrate is of the size designated by the makers H_3; it produces a current having an electromotive force of 110 volts, and will feed 550 lamps requiring .72 amperes each.

The Brush Company early acquired the Lane-Fox patents for the manufacture of electric lamps, and have since greatly improved the process, increasing the brilliancy of the illumination and the duration of the filament, as well as their economy, their consumption of energy being now only three watts per candle-power. The lamps are made in four sizes of 10, 20, 40 and 50 candle-power, and in two series intended to work with 60 and 100 volts. In addition to these, 80 volt lamps of 10 and 20 candle-power are made for the Admiralty, in order that they may be supplied by the same dynamo which feeds the search light, it having been found that for a hand-regulated lamp, giving 25,000 actual candle-power, a difference of potential of 80 volts gives the most satisfactory results, as small irregularities of feeding do not interrupt the current or greatly vary the resistance of the long arc which can be maintained.

The method of mounting the lamp is exceedingly neat, and has the advantage of not leaving any delicate platinum loops exposed to rough usage. The conductors which pass through the glass are soldered on the outside to copper wires; the neck of the globe is surrounded with a brass ferrule cemented in its place, and having its outer end stopped with a plug of non-conducting material through which these copper wires pass. In the end of the plug there are two brass cheese-headed screws, and around these the copper wires are wound, so that the screw heads are in contact with them, and thus form the terminals of the lamp. The holder is a convolvulus shaped cup, with the edge divided into a number or petal-like fingers, which embrace the lamp globe, and exert an elastic pressure upon it.

Many of the Brush incandescent installations have been made on the ships of the Royal Navy, and their fittings for ships' use are therefore of an especially solid and handsome type. Two of them are illustrated by Figs. 4 and 5, one being of a more ornamental type than the other. The lantern inclosed in the grating is designed for use in passages, between decks, and other situations where it is liable to come in contact with passing objects. The other is intended to be fixed in cabins and state-rooms. In addition to these, a complete set of brackets have been manufactured suitable for use in the engine-room, stokehole, bunkers and other parts of the ship, some of them being permanently fixed, and some supplied with flexible conductors by which they can be connected to any of the numerous contact sockets fixed about the engine-room. Each bracket is usually provided with a fusible cut-out, while larger cut-outs are arranged in each of the sectional circuits.

Among the ships lighted by the Brush Company are the Dolphin, Bacchante, Raleigh, Conqueror and Colossus. All of them have both search lights and internal incandescent lights, and the dynamos can be applied to one or other of these purposes, as required. The Bacchante, Raleigh and Conqueror have each two F_2 dynamos, which will feed search lights of 25,000 candle-power, or 200 incandescent lamps of 20 candle-power. The Colossus has three such generators, and 600 incandescent lamps.—*Engineering.*

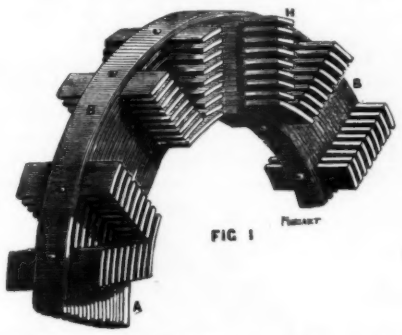


FIG. 1

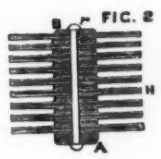
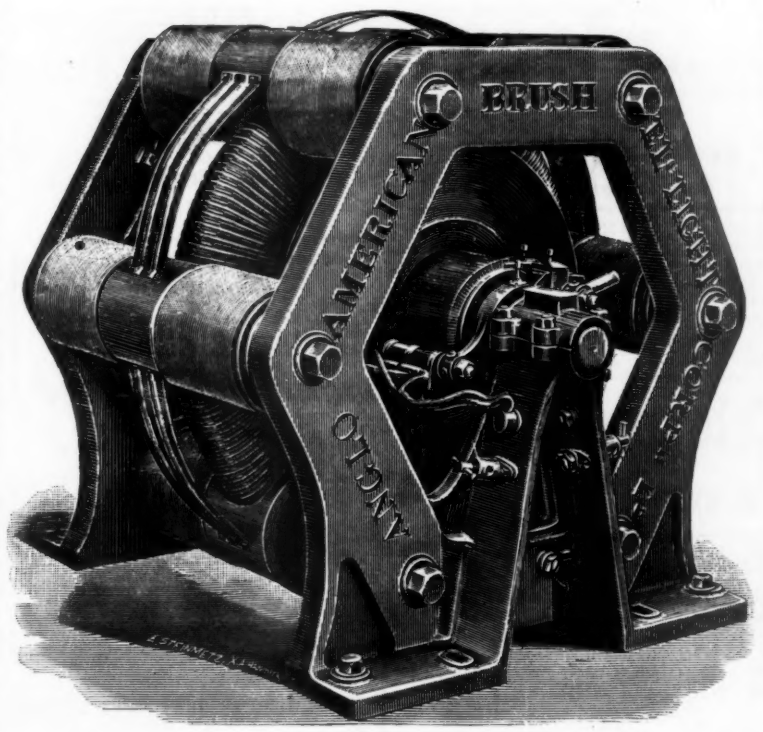


FIG. 2

FIG. 3

ARMATURE CORE FOR BRUSH DYNAMO MACHINE.



VICTORIA DYNAMO MACHINE, CONSTRUCTED BY THE ANGLO-AMERICAN ELECTRIC LIGHTING CORPORATION.

—— An isolated plant of 1,000 United States lights has been put in the Chelsea Flats.

ELECTRIC LIGHT NEWS

—— The Edison isolated plant of 150 lights at Messrs. Aiken, Sons & Co., Eighteenth Street and Broadway, has been replaced by the United States Illuminating Company.

—— The United States Illuminating Company are lighting the Broadway Tabernacle with 200 incandescent Weston lights. The circuit is about five miles long, and is fed from the Stanton Street station. The Tabernacle people believe in a good light as well as religion.

—— Our esteemed contemporary the *Milling World* says that if anybody doubts the possibilities of electric lighting for the illumination of even the remotest corner of a large building, let him make a trip to Philadelphia and take a stroll through the Electrical Exhibition. Electric light may be a little more expensive now than gas or oil light, but we must not forget that the quantity of the latter is less, its quality poorer, its liability to produce a conflagration in mills vastly higher, and the avoidance of these three factors should be worth something.

—— Dr. W. H. Stone, F. R. S., who recently read a paper on the physiological bearing of electricity on health at the International Health Exhibition, on the occasion of the conference held there by the Society of Telegraph Engineers and Electricians, has devised a pair of spectacles or eye protectors for persons who are in the habit of working by or with electric light. The spectacles are made by Mr. Baker, of High Holborn, and consist of front glasses of blue, with attached side glasses or "blinkers" of red glass. The danger to the eye from the incandescent lamp is likely to arise from the red or heat rays; that from the arc lamp is due to excess of blue or actinic rays; hence the use of two glasses. In looking at the incandescent light through the blue glasses the glare is removed and irritation from the intense yellow and red rays prevented, while, after folding down the red side glasses over the blue front ones, the arc light can be looked at with safety through the joint media. The tints of the glasses are selected and combined by the help of the spectroscope.

The American Electric and Illuminating Company.

A very important meeting of the full board of the directiors of the American Electric and Illuminating Company was held on Wednesday, at which a very close and thorough analysis of the affairs and operations of the company was gone into. The result was surprisingly satisfactory even to the board, and both the finances and the business of the company were found to be in admirable condition owing to the rapid increase in the business. It was decided to establish several departments of work, the head of each to have full authority and be held rigidly responsible for the operations of his department. The steam power, engineering, etc., of all the plants to be constructed by the company will be in the hands of Maj. L. V. Wright, the mechanical engineer of the company. The introduction of isolated plants in mills, factories, etc., will be committed to Mr. H W. Burgett, manager of the isolated plant department. The accounts of the American Company, and of all its sub-companies, will be supervised by Mr. F. Montague Sawdon, auditor; and the finances of the parent company will be handled by Capt. J. C. Irvine, brother of the late treasurer, who has in the past had much experience with the company, and now returns as its treasurer. Of course Mr. Edward H. Goff retains his general supervision of all the affairs of the company, as its president, and Mr. C. D. Smith, who has been associated with Mr. Goff since the outset, holds his position as general manager. With the perfected organization the progress of the American Company promises to be even more rapid than heretofore.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING SEPTEMBER 23, 1884.

305,431 Galvanometer; William G. David, Lyons, N. Y.

305,475 Electrical conductor; Thomas S. Reed, Bridgeport, Conn., assignor to the Bridgeport Brass Company, same place.

305,552 Telephone switch; Henry E. Waite, New York, N. Y.

305,595 Automatic electric shut-off for water and gas pipes; Thomas Pyke Hughes, Denver, Col.

305,601 Joint for electric conductors; Richard W. Kear, Pottsville, Pa.

305,611 Electrical signaling apparatus; J. Kenneth D. Mackenzie, Westminster, county of Middlesex, England.

305,617 Electric arc lamp; Richard H. Mather, Windsor, Conn.

305,632 Secondary electric tower clock; Chester H. Pond, New York, N. Y., and Alfred S. Munger, Brooklyn, assignors to the Time Telegraph Company, New York, N. Y.

305,688 Electric fire-alarm and call-bell system; P. Gugerty, Waterford, N. Y., assignor by mesne assignments to Mary E. Gugerty, same place.

305,694 Electric railway; Walter H. Knight, Cleveland, O.

305,726 Electric device for lighting gas; Horatio N. Williams, Providence, R. I., assignor of two-thirds to John Duxbury and Charles P. Braun, both of same place.

305,729 Electric railway; Edward M. Bentley, Brooklyn, N. Y.

305,730 Electric railway; Benson Bidwell, Grand Rapids, Mich.

305,731 Electric railway; Walter H. Knight, New York, N. Y.

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1865, will be furnished by any of the patent solicitors whose advertisements appear in this journal. In ordering please state the number and date of the patent desired.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40.00. Various other Foreign patents may also be obtained.

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Any of our readers having copies of the old REVIEW of the TELEGRAPH AND TELEPHONE, dated March 15th, 1882 (No. 3), not specially needed by them, will confer a great favor upon us by sending them to this office, for which we will remit twenty-five cents per copy. DELANO & COMPANY,
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